

ATTACHMENT B

ROUTINE MAINTENANCE CHARTS

ATTACHMENT B-1
Cardinal 1: CI 71448 and 71516¹

Unit Info./ Activity	600MW/1967 ² CI 71448: Replaced all five existing pulverizers and added 10 additional burners; approved by the Board of Directors on November 15, 1977. ³ CI 71516: Replaced the primary superheater and horizontal reheater; approved on July 25, 1978. ⁴ Both CIs were revised with increased approval amounts; CI 71448, Rev. 1 was approved on March 6, 1981 and CI 71516, Rev. 1 was approved on August 27, 1980. ⁵
Nature	These two projects were called the "Big Fix" by AEP employees and involved replacing the unit's five pulverizers with upgraded components, adding 10 burners to the unit, replacing the primary superheater with a series of 13 wingwalls in the primary furnace, and using the extra space gained by eliminating the primary superheater to accommodate a new, larger horizontal reheater. ⁶ AEP hired Babcock & Wilcox and Catalytic Inc. to replace the equipment. ⁷ The costs of both projects were capitalized. ⁸
Extent	Babcock & Wilcox devoted 69,337 man-hours to replacing the pulverizers and installing the new burners and another 284,981 man-hours in replacing the superheater and reheater materials. ⁹
Outage Dates	The work in these two "Big Fix" CIs was spread into two phases. First AEP replaced the pulverizers between October 1978 and September 1979. ¹⁰ The company then installed the new burners and replaced the superheater and reheater components during an outage lasting from December 14, 1979 to May 8, 1980. ¹¹
Purpose	AEP conducted the replacements in these two "Big Fix" CIs to eliminate a 70 MW loss of capacity in the unit. ¹² The company believed that replacing the pulverizers with upgraded equipment and adding burners would eliminate 25 MW of lost capacity, while replacing the primary superheater and horizontal reheater with redesigned components would eliminate the other 45 lost MW. ¹³ Even operating at reduced capacity, the replaced components caused hundreds of thousands of hours of lost generation before the project. AEP estimated that pulverizer unavailability resulted in an average of 190,000 MWH per year in lost generation over the three years before CI 71448 was written and that replacing the pulverizers could improve unit availability between 1 and 2%. ¹⁴ The company calculated that tube leaks in the replaced components caused an additional 139,000 MWH of lost generation per year over the five years preceding CI 71516. ¹⁵
Frequency	The designs and replacements in these two CIs had never been performed before at the unit. ¹⁶
Capital Cost	CI 71448: Installation cost \$8,991,983 ¹⁷ CI 71516: Installation cost \$12,807,816; Removal cost \$2,787,604 ¹⁸

1. See generally Hekking Rpt. (Pl. Ex. 1) at 60-74.

2. AEP System Generating Capability Commercial Operation Dates and Maximum Generator Name Plate Ratings (Pl. Ex. 118) at AEPHQ145017; Joint Stip. ¶ 42; Hekking Rpt. (Pl. Ex. 1) at 60.
3. Capital Improvement Req. # 71448 (Jt. Ex. 64) at CD184741; Hekking Rpt. (Pl. Ex. 1) at 67.
4. Approval of Improvement Req., Aug. 7, 1978 (Jt. Ex. 150); Hekking Rpt. (Pl. Ex. 1) at 92-93.
5. Capital Improvement Req. # 71448, Rev. 1 (Jt. Ex. 262) at CD173583; Capital Improvement Req. # 71516, Rev. 1 (Jt. Ex. 188) at AEPHQ130407.
6. Capital Improvement Req. # 71448 (Jt. Ex. 64) at CD184743; Capital Improvement Req. # 71516 (Jt. Ex. 150) at CD173354; 600 MW Unit Big Fix Modifications, Mar. 21, 1977 (Pl. Ex. 1030) at CD143089; Hekking Rpt. (Pl. Ex. 1) at 60, 65, 66-67 and 70-71; Tuppeny Rpt. (Def. Ex. 1524) at 82.
7. Report on Audit MPS-89 Pulverizers and Burner Additions, Sept. 26, 1980 (Pl. Ex. 482) at CD184729; Purchase Order Number 28448-221-8, Sept. 7, 1978 (Pl. Ex. 196); Hekking Rpt. (Pl. Ex. 1) at 68 and 69; Tuppeny Rpt. (Def. Ex. 1524) at 82.
8. Capital Improvement Req. # 71448, Rev. 1 (Jt. Ex. 262); Capital Improvement Req. # 71516, Rev. 1 (Jt. Ex. 188).
9. B & W Manhours Comparison During Big Fix Outages, Oct. 27, 1980 (Pl. Ex. 55); Hekking Rpt. (Pl. Ex. 1) at 71.
10. Cardinal 1 and 2 CR77 Removal and MPS Installation (Pl. Ex. 293); Tuppeny Rpt. (Def. Ex. 1524) at 86; Hekking Rpt. (Pl. Ex. 1) at 68.
11. Plant Weekly Letter, Dec. 21, 1979 (Jt. Ex. 160) at CD219461; Plant Weekly Letter, May 16, 1980 (Jt. Ex. 159) at CD219367; Tuppeny Rpt. (Def. Ex. 1524) at 83; Hekking Rpt. (Pl. Ex. 1) at 69.
12. Capital Improvement Req. # 71448 (Jt. Ex. 64) at CD184743; Capital Improvement Req. # 71516 (Jt. Ex. 150) at CD173354; Hekking Rpt. (Pl. Ex. 1) at 63.
13. Capital Improvement Req. # 71448 (Jt. Ex. 64) at CD184743-744; Capital Improvement Req. # 71516 (Jt. Ex. 150) at CD173355; Michael Doherty Depo. at 56:10-14, 56:16-19, 56:21, 58:8-13; Hekking Rpt. (Pl. Ex. 1) at 65 and 66; Tuppeny Rpt. (Def. Ex. 1524) at 85.
14. Capital Improvement Req. # 71448 (Jt. Ex. 64) at CD184743-744; Michael Doherty Depo. at 49:13-50:13, 58:8-13; Hekking Rpt. (Pl. Ex. 1) at 65 and 66.
15. Capital Improvement Req. # 71516 (Jt. Ex. 150) at CD173354-355; Michael Doherty Depo. at 86:5-22; Hekking Rpt. (Pl. Ex. 1) at 63.

16. Major Boiler Assessment List - Cardinal Unit 1 (Pl. Ex. 466); Hekking Rpt. (Pl. Ex. 1) at 71-72; Tuppeny Rpt. (Def. Ex. 1524) at 82 and 87.

17. Electric Plant in Service - Structures and Equipment (Pl. Ex. 455); Hekking Rpt. (Pl. Ex. 1) at 72; Larkin Rpt. (Pl. Ex. 1189) at 33.

18. Electric Plant in Service - Structures and Equipment (Pl. Ex. 455) at AT003168 and 003169; Work Order Completion Reports, 978/8305 (Pl. Ex. 504) at CD338397-398; Hekking Rpt. (Pl. Ex. 1) at 71; Larkin Rpt. (Pl. Ex. 1189) at 31-32.

ATTACHMENT B-2
Cardinal 1: CI 72373¹

Unit Info./ Activity	600MW/1967 ² CI 72373: Replaced the lower furnace waterwall tubes; approved by the Board of Directors on September 28, 1988. ³
Nature	AEP hired Babcock & Wilcox to replace the entire furnace, except for the roof, floor, and rear wall arch. ⁴ The company hired Babcock & Wilcox without soliciting bids on the project, concluding that the “complexity of the lower furnace and the design modifications that we require” meant it was “the only qualified manufacturer.” ⁵ The new equipment included “a revised design” with “heavier wall tubing of a higher alloy grade.” ⁶ The project was approved by more than 10 people, including the AEP president and the chairman of the board of directors. ⁷ The costs of the project were capitalized. ⁸
Extent	The lower primary furnace consisting of the entire first and second pass tubing with its inlet and outlet headers, and third pass tubes and inlet headers in the mix area, were replaced. ⁹ The project required replacing 774 first-pass furnace tubes, 742 second-pass tubes, and 1041 third-pass tubes, along with inlet and outlet headers. ¹⁰ The replaced lower furnace tube walls were each more than 100-feet high. ¹¹ AEP estimated it would take more than 214,000 man-hours to remove the old components and install their replacements. ¹²
Outage Dates	The front half of the lower furnace was replaced during an outage lasting from March 23, 1990 to June 24, 1990. ¹³ The rear half of the lower furnace was replaced during an outage lasting from September 6, 1991 to December 13, 1991. ¹⁴
Purpose	AEP replaced the tubing with material of an improved design to ensure the replaced components “will be dependable for at least 25 additional years.” ¹⁵ The old components had been responsible for 50 percent of the unit outages over the five years before the replacement; the outage rate attributed to the lower furnace was 6.5%. ¹⁶ AEP expected the replacement to increase unit availability by 13% while also reducing maintenance costs. ¹⁷ It projected that tube leaks in the lower furnace would cause 1152 hours per year of forced outage time (escalating at a rate of 20% per year), at a cost of \$1,939,810 per year in lost sales, if the tubes were not replaced. ¹⁸
Frequency	The project marked the first time the entire lower furnace was replaced. ¹⁹
Capital Cost	The cost was \$12,913,784 for installation, and removal costs were estimated at \$2,309,000. ²⁰

1. See generally Hekking Rpt. (Pl. Ex. 1) at 60 and 75-81.

2. AEP System Generating Capability Commercial Operation Dates and Maximum Generator Name Plate Ratings (Pl. Ex. 118) at AEPHQ145; Joint Stip. ¶ 42; Hekking Rpt. (Pl. Ex. 1) at 75.

3. Capital Improvement Req. # 72373 (Jt. Ex. 11) at AEPHQ130480.
4. Cardinal Plant – Units 1 and 2 Contract Letter CD1&2-90, Dec. 27, 1989 (Pl. Ex. 283); Specification CD/MR-0589, Aug. 3, 1989 (Pl. Ex. 284) at ARC-CD112218; David Wehner Depo. at 78:17-80:8 and 149:19-151:14; Hekking Rpt. (Pl. Ex. 1) at 79; Tuppeny Rpt. (Def. Ex. 1524) at 95.
5. Cardinal Unit 1 Lower Furnace Replacement, Aug. 3, 1988 (Pl. Ex. 166); Hekking Rpt. (Pl. Ex. 1) at 79; Tuppeny Rpt. (Def. Ex. 1524) at 95.
6. Tuppeny Rpt. (Def. Ex. 1524) at 95; Hekking Rpt. (Pl. Ex. 1) at 78-79.
7. Capital Improvement Req. # 72373 (Jt. Ex. 11) at AEPHQ130480; David Wehner Depo. at 31:19-34:2.
8. Property Location Ledger, Cardinal Unit 1, May 1998 (Pl. Ex. 459); Hekking Rpt. (Pl. Ex. 1) at 80.
9. Capital Improvement Req. # 72373 (Jt. Ex. 11) at AEPHQ130486; Hekking Rpt. (Pl. Ex. 1) at 77.
10. Capital Improvement Req. # 72373 (Jt. Ex. 11) at AEPHQ130480; Tuppeny Rpt. (Def. Ex. 1524) at 93 and 94; David Wehner Depo. at 34:15-36:9; Hekking Rpt. (Pl. Ex. 1) at 77.
11. Proposal – Furnace Replacement Material, Aug. 2, 1988 (Pl. Ex. 465); David Wehner Depo. at 34:15-36:9.
12. Capital Improvement Req. # 72373 (Jt. Ex. 11) at AEPHQ130490; David Wehner Depo. at 95:22-96:10.
13. Cardinal Plant Unit 1-Outage 191, July 3, 1990 (Pl. Ex. 289); Hekking Rpt. (Pl. Ex. 1) at 80.
14. Cardinal Plant Unit 1-Outage 212, Jan. 6, 1992 (Pl. Ex. 964); Hekking Rpt. (Pl. Ex. 1) at 80.
15. Capital Improvement Req. # 72373 (Jt. Ex. 11) at AEPHQ130482; David Wehner Depo. at 41:21-43:14 and 56:14-57:9; Hekking Rpt. (Pl. Ex. 1) at 76.
16. Capital Improvement Req. # 72373 (Jt. Ex. 11) at AEPHQ130485; Hekking Rpt. (Pl. Ex. 1) at 77; Tuppeny Rpt. (Def. Ex. 1524) at 95.
17. Capital Improvement Req. # 72373 (Jt. Ex. 11) at AEPHQ130486; David Wehner Depo. at 26:1-31:18, 46:20-49:23, 52:18-53:8 and 70:10-17; Hekking Rpt. (Pl. Ex. 1) at 77.
18. Capital Improvement Req. # 72373 (Jt. Ex. 11) at AEPHQ130491-493; David Wehner Depo. at 65:12-68:6 and 69:1-70:9.
19. Improvement Requisition CI # 72373 Cardinal Plant Unit 1 Advanced Approval Request, July 22, 1988 (Pl. Ex. 167).

20. Property Location Ledger, Cardinal Unit 1, May 1998 (Pl. Ex. 459); Capital Improvement Req. # 72373 (Jt. Ex. 11) at AEPHQ130484; Hekking Rpt. (Pl. Ex. 1) at 80; Larkin Rpt. (Pl. Ex. 1189) at 35.

ATTACHMENT B-3
Cardinal 1: CI 72201¹

Unit Info./ Activity	600MW/1967 ² CI 72201: Replaced five primary air fan motors; approved by an AEP Vice Chairman's blanket approval on October 29, 1986. ³
Nature	The Ohio Centralized Plant Maintenance organization within the Ohio Power Company to performed the work. ⁴ AEP replaced the old, 700 HP fans (which were creating bottlenecks due to their lesser power) with 900 HP fans. ⁵ The project was approved by nine people. ⁶ The cost of the replacement was capitalized. ⁷
Extent	AEP estimated it would take 1,300 man-hours to remove the old and install the new fans. ⁸
Outage Dates	The outage lasted from September 2, 1988 to October 22, 1988. ⁹
Purpose	Prior to the replacement of the 700 HP motors, the MPS pulverizers were limited to a loading of 108,000 lbs coal per hour. ¹⁰ AEP expected the replacement of the 700 HP motors with the 900 HP motors would allow the pulverizers to perform at their design rate of 120,000 lbs coal per hour. ¹¹ The replacements were expected do a number of things including: eliminating a 20 to 50 MW curtailment, thereby allowing Unit 1 to operate at its full load capacity of 600 MW with one pulverizer out of service; reducing load curtailments by at least 25,000 MW-hours per year; and obtaining a net savings of \$1,246,000. ¹² The 900 HP motors' service life was estimated at 30 years, which matched the remaining service life of Unit 1. ¹³
Frequency	The primary air fans "were part of the original equipment" of the unit. ¹⁴
Capital Cost	\$235,045 ¹⁵

1. See generally Hekking Rpt. (Pl. Ex. 1) at 60 and 82-84.
2. AEP System Generating Capability Commercial Operation Dates and Maximum Generator Name Plate Ratings (Pl. Ex. 118) at AEPHQ145017; Joint Stip. ¶ 42; Hekking Rpt. (Pl. Ex. 1) at 75.
3. Approval Notice, Oct.31, 1986 (Jt. Ex. 61); Hekking Rpt. (Pl. Ex. 1) at 83.
4. Ohio Centralized Plant Maintenance Division Cardinal Unit 1 Outage Plan 09/06/88 thru 10/22/88 (Pl. Ex. 290); Hekking Rpt. (Pl. Ex. 1) at 83-84; Tuppeny Rpt. (Def. Ex. 1524) at 92.
5. Capital Improvement Req. # 72201 (Jt. Ex. 59) at CD172376; Hekking Rpt. (Pl. Ex. 1) at 83 and 84.
6. Capital Improvement Req. # 72201 (Jt. Ex. 59) at CD172376.

7. Work Order Completion Report, 705/2300 (Jt. Ex. 60).
8. Ohio Centralized Plant Maintenance Division, Cardinal Unit 1 Outage Plan 09/06/88 thru 10/22/88 (Pl. Ex. 290) at ARC-CD119329 and 119341; Hekking Rpt. (Pl. Ex. 1) at 83.
9. Manager's Weekly Letters, 1988 (Pl. Ex. 495) at CD217405-411 and CD217445-449; Hekking Rpt. (Pl. Ex. 1) at 83.
10. Capital Improvement Req. # 72201 (Jt. Ex. 59) at CD172378; Hekking Rpt. (Pl. Ex. 1) at 82-83.
11. Capital Improvement Req. # 72201 (Jt. Ex. 59) at CD172378; Hekking Rpt. (Pl. Ex. 1) at 82-83.
12. Capital Improvement Req. # 72201 (Jt. Ex. 59) at CD172378; Hekking Rpt. (Pl. Ex. 1) at 83; Tuppeny Rpt. (Def. Ex. 1524) at 92.
13. Capital Improvement Req. # 72201 (Jt. Ex. 59) at CD172378.
14. Hekking Rpt. (Pl. Ex. 1) at 82 and 84; Tuppeny Rpt. (Def. Ex. 1524) at 91.
15. Work Order Completion Report, 705/2300 (Jt. Ex. 60); Larkin Rpt. (Pl. Ex. 1189) at 37; Hekking Rpt. (Pl. Ex. 1) at 84.

ATTACHMENT B-4
Cardinal 2: CI 71449 and 71517¹

Unit Info./ Activity	600MW/1967 ² CI 71449: Replaced four of the existing pulverizers and added 10 additional burners; approved on December 20, 1977. ³ CI 71517: Replaced the primary superheater and horizontal reheater; approved on July 25, 1978. ⁴ Both CIs were revised with increased approval amounts and were approved by the Chairman on March 31, 1981 and the Board of Directors on May 27, 1981. ⁵
Nature	These two projects were called the "Big Fix" by AEP employees and involved replacing the unit's four of the pulverizers with upgraded components, adding 10 burners to the unit, replacing the primary superheater with a series of 13 wingwalls in the primary furnace, and using the extra space gained by eliminating the primary superheater to accommodate a new, larger horizontal reheater. ⁶ AEP hired Babcock & Wilcox and Catalytic Inc. to replace the equipment. ⁷ The costs of both projects were capitalized. ⁸
Extent	Babcock & Wilcox devoted 75,064 man-hours to replacing the pulverizers and installing the new burners and another 275,600 man-hours in replacing the superheater and reheater materials. ⁹
Outage Dates	The work in these two "Big Fix" CIs was spread into two phases. First AEP replaced the pulverizers between August 1978 and July 1979. ¹⁰ The company then installed the new burners and replaced the superheater and reheater components during an outage lasting from May 15, 1980 to September 27, 1980. ¹¹
Purpose	AEP conducted the replacements in these two "Big Fix" CIs to eliminate a 70 MW loss of capacity in the unit. ¹² The company believed that replacing the pulverizers with upgraded equipment and adding burners would eliminate 25 MW of lost capacity, while replacing the primary superheater and horizontal reheater with redesigned components would eliminate the other 45 lost MW. ¹³ Even operating at reduced capacity, the replaced components caused hundreds of thousands of hours of lost generation before the project. AEP estimated that pulverizer unavailability resulted in an average of 190,000 MWH per year in lost generation over the three years before CI 71449 was written and that replacing the pulverizers could improve unit availability between 1 and 2%. ¹⁴ The company calculated that tube leaks in the replaced components caused an additional 104,000 MWH of lost generation per year over the four years preceding CI 71517. ¹⁵
Frequency	The designs and replacements in these two CIs had never been performed before at the unit. ¹⁶
Capital Cost	CI 71449: Installation cost \$8,608,255 ¹⁷ CI 71517: Installation cost \$12,925,154; Removal cost \$2,470,033 ¹⁸

1. See generally Hekking Rpt. (Pl. Ex. 1) at 60 and 85-99.

2. AEP System Generating Capability Commercial Operation Dates and Maximum Generator Name Plate Ratings (Pl. Ex. 118) at AEPHQ145017; Joint Stip. ¶ 42; Hekking Rpt. (Pl. Ex. 1) at 85.
3. Approval of Improvement Req., Dec. 29, 1977 (Jt. Ex. 216); Hekking Rpt. (Pl. Ex. 1) at 92-93.
4. Approval of Improvement Req., Aug. 7, 1978 (Jt. Ex. 150); Hekking Rpt. (Pl. Ex. 1) at 92-93.
5. Capital Improvement Req. # 71449, Rev. 1 (Jt. Ex. 211) at ARC-CORPB-COL228808; Capital Improvement Req. # 71517, Rev. 1 (Jt. Ex. 214) at ARC-CORPB-COL229358.
6. Capital Improvement Req. # 71449 (Jt. Ex. 44) at ARC-CORPB-COL228822; Capital Improvement Req. # 71517 (Jt. Ex. 225) at CD173379; Hekking Rpt. (Pl. Ex. 1) at 90, 91 and 95; Tuppeny Rpt. (Def. Ex. 1524) at 82.
7. Report on Audit MPS-89 Pulverizers and Burner Additions, Sept. 26, 1980 (Pl. Ex. 482) at CD184729; Purchase Order Number 28448-221-8, Sept. 7, 1978 (Pl. Ex. 196); Hekking Rpt. (Pl. Ex. 1) at 93 and 94; Tuppeny Rpt. (Def. Ex. 1524) at 82.
8. Work Order Completion Report, 978/8186, Rev. 1 (Pl. Ex. 489) at CD192883 and 192884; Work Order Completion Report, 978/8304 (Jt. Ex. 231).
9. B & W Manhours Comparison During Big Fix Outages, Oct. 27, 1980 (Pl. Ex. 55); Hekking Rpt. (Pl. Ex. 1) at 95.
10. Weekly Letter for Cardinal, Sept. 8, 1978 (Pl. Ex. 1056) at CD219760; Weekly Letter for Cardinal, July 27, 1979 (Jt. Ex. 162) at CD219554.
11. Tuppeny Rpt. (Def. Ex. 1524) at 83; Hekking Rpt. (Pl. Ex. 1) at 94.
12. Capital Improvement Req. # 71449 (Jt. Ex. 44) at ARC-CORPB-COL228821; Hekking Rpt. (Pl. Ex. 1) at 88.
13. Capital Improvement Req. # 71449 (Jt. Ex. 44) at ARC-CORPB-COL228821; Capital Improvement Req. # 71517 (Jt. Ex. 225) at CD173380; Michael Doherty Depo. at 115:16-116:5, 123:6-15; Hekking Rpt. (Pl. Ex. 1) at 90 and 91; Tuppeny Rpt. (Def. Ex. 1524) at 85.
14. Capital Improvement Req. # 71449 (Jt. Ex. 44) at ARC-CORPB-COL228822; Michael Doherty Depo. at 115:16-116:5; Hekking Rpt. (Pl. Ex. 1) at 90 and 91.
15. Capital Improvement Req. # 71517 (Jt. Ex. 225) at CD173379; Michael Doherty Depo. at 122:7-123:15; Hekking Rpt. (Pl. Ex. 1) at 88.
16. Major Boiler Assessment List - Cardinal Unit 2 (Pl. Ex. 467); Hekking Rpt. (Pl. Ex. 1) at 96; Tuppeny Rpt. (Def. Ex. 1524) at 82 and 87.
17. Work Order Completion Report, 978/8186 Rev. 1 (Pl. Ex. 489) at CD192883 and 192884; Hekking Rpt. (Pl. Ex. 1) at 96; Larkin Rpt. (Pl. Ex. 1189) at 41.

18. Work Order Completion Report, 978/8304 (Jt. Ex. 231); Work Order Completion Report, 978/8306 (Jt. Ex. 232); Hekking Rpt. (Pl. Ex. 1) at 96; Larkin Rpt. (Pl. Ex. 1189) at 39.

ATTACHMENT B-5
Cardinal 2: CI 98085¹

Unit Info./ Activity	600MW/1967 ² CI 98085: Replaced lower furnace tubes; approved by the Chairman on September 12, 1988 and the Board of Directors on September 28, 1988. ³
Nature	AEP hired Babcock & Wilcox to replace the entire Unit 2 furnace except for the roof, floor, and rear wall arch. ⁴ The new equipment included "a revised design" with "heavier wall tubing of a higher alloy grade." ⁵ The project was approved by the Chairman and Board of Directors. ⁶ The work was funded as a capital project. ⁷
Extent	The lower primary furnace consisting of the entire first and second pass tubing with its inlet and outlet headers, and third pass tubes and inlet headers in the mix area, were replaced. ⁸ The project required replacing 774 first-pass furnace tubes, 742 second-pass tubes, and 1041 third-pass tubes, along with inlet and outlet headers. ⁹ The replaced lower furnace tube walls were each more than 100-feet high. ¹⁰ AEP estimated it would take more than 216,000 man-hours to remove the old components and install their replacements. ¹¹
Outage Dates	The front half of the lower furnace was replaced during an outage lasting from February 1, 1991 to April 28, 1991, while the rear lower half was replaced during an outage lasting from September 25, 1992 to December 30, 1992. ¹²
Purpose	The project was intended to "assure continued operation of the unit for an expected service life of at least an additional 25 years." ¹³ The old components had been responsible for 52% of the unit outages over the five years before the replacement, for an average forced unit outage rate of 5% due solely to furnace wall problems. ¹⁴ AEP expected the replacement to increase unit availability by 13% while also reducing maintenance costs. ¹⁵ It projected that tube leaks in the lower furnace would cause 1152 hours per year of forced outage time (escalating at a rate of 20% per year), at a cost of \$2,156,667 per year in lost sales, if the tubes were not replaced. ¹⁶
Frequency	This was the first time that the lower furnace was replaced in its entirety. ¹⁷
Capital Cost	Installation costs were \$11,995,769, while removal costs were \$3,255,955. ¹⁸

1. See generally Hekking Rpt. (Pl. Ex. 1) at 60 and 104-110.

2. AEP System Generating Unit Effective Life Time Assumptions, Oct. 6, 1988 (Pl. Ex. 1457) at ARC-RPBUD-COL125231 and 125234; Joint Stip. ¶ 42; Hekking Rpt. (Pl. Ex. 1) at 104.

3. Capital Improvement Req. # 98085 (Jt. Ex. 129) at ARC-CD125480-481; Improvement Requisition Approval Notice, Oct. 3, 1988 (Jt. Ex. 206); Hekking Rpt. (Pl. Ex. 1) at 107.

4. Contract Letter CD 1&2-90, Dec. 27, 1989 (Pl. Ex. 283); David Wehner Depo. at 78:17-80:8 and 149:19-151:14; Hekking Rpt. (Pl. Ex. 1) at 109; Tuppeny Rpt. (Def. Ex. 1524) at 95.
5. Tuppeny Rpt. (Def. Ex. 1524) at 95; Hekking Rpt. (Pl. Ex. 1) at 78-79.
6. Capital Improvement Req. # 98085 (Jt. Ex. 129) at ARC-CD125481; David Wehner Depo. at 101:14-102:15.
7. Capital Improvement Req. # 98085 (Jt. Ex. 129) at ARC-CD125481; Hekking Rpt. (Pl. Ex. 1) at 105.
8. Capital Improvement Req. # 98085 (Jt. Ex. 129) at ARC-CD125486; Hekking Rpt. (Pl. Ex. 1) at 106.
9. Capital Improvement Req. # 98085 (Jt. Ex. 129) at ARC-CD125481; Tuppeny Rpt. (Def. Ex. 1524) at 93 and 94; Hekking Rpt. (Pl. Ex. 1) at 106.
10. Proposal – Furnace Replacement Material, Aug. 2, 1988 (Pl. Ex. 465); Hekking Rpt. (Pl. Ex. 1) at 107.
11. Capital Improvement Req. # 98085 (Jt. Ex. 129) at ARC-CD125490.
12. Cardinal Plant, Manager's Weekly Letters, 1991 (Pl. Ex. 492) at CD213819 and 213907; Cardinal Plant, Manager's Weekly Letters, 1992 (Pl. Ex. 491) at CD213023-024 and 213142; Hekking Rpt. (Pl. Ex. 1) at 109.
13. Capital Improvement Req. # 98085 (Jt. Ex. 129) at ARC-CD125486; Hekking Rpt. (Pl. Ex. 1) at 105.
14. Capital Improvement Req. # 98085 (Jt. Ex. 129) at ARC-CD125485; David Wehner Depo. at 104:17-106:17; Hekking Rpt. (Pl. Ex. 1) at 106; Tuppeny Rpt. (Def. Ex. 1524) at 95.
15. Capital Improvement Req. # 98085 (Jt. Ex. 129) at ARC-CD125486; David Wehner Depo. at 110:3-111:7.
16. Capital Improvement Req. # 98085 (Jt. Ex. 129) at ARC-CD125491.
17. Tuppeny Rpt. (Def. Ex. 1524) at 94; Hekking Rpt. (Pl. Ex. 1) at 110.
18. Work Order Completion Report, 978/9684 (Jt. Ex. 228); Work Order Completion Report, 978/9685 (Jt. Ex. 229); Hekking Rpt. (Pl. Ex. 1) at 109; Larkin Rpt. (Pl. Ex. 1189) at 44.

ATTACHMENT B-6**Cardinal 2: CI 98066¹**

Unit Info./ Activity	600MW/1967 ² CI 98066: Replaced four primary air fan motors; approved by an AEP Vice Chairman's blanket approval on October 29, 1986. ³
Nature	The Ohio Centralized Plant Maintenance organization within the Ohio Power Company to performed the work. ⁴ AEP replaced the old, 700 HP fans (which were creating bottlenecks due to their lesser power) with 900 HP fans. ⁵ The project was approved by 10 people. ⁶ The cost of the replacement was capitalized. ⁷
Extent	AEP replaced four 700 HP motors with new, larger 900 HP motors.
Outage Dates	The fans were replaced one at a time, often while the unit was in operation. One of the air fan motors was replaced starting about January 14, 1988, before the scheduled outage, which began on February 2, 1988 and lasted until April 10, 1988. ⁸ The other three motors were replaced one each in April, May and August of 1988. ⁹ Replacement of the last motor was completed on or about August 31, 1988. ¹⁰
Purpose	Prior to the replacement of the 700 HP motors, the MPS pulverizers were limited to a loading of 108,000 lbs coal per hour. ¹¹ AEP expected the replacement of the 700 HP motors with the 900 HP motors would allow the pulverizers to perform at their design rate of 120,000 lbs coal per hour. ¹² The replacements were expected do a number of things including: eliminating a 20 to 50 MW curtailment, thereby allowing Unit 2 to operate at its full load capacity of 600 MW with one pulverizer out of service; reducing load curtailments by at least 25,000 MW-hours per year; and obtaining a net savings of \$1,331,000. ¹³ AEP also expected the additional electrical generation available for sale to be worth \$81,245 per year (escalated at 6% per year). ¹⁴ The 900 HP motors' service life was estimated at 30 years, which matched the remaining service life of Unit 2. ¹⁵
Frequency	The primary air fans "were part of the original equipment" of the unit. ¹⁶
Capital Cost	The cost was \$172,391 for installation. ¹⁷

1. See generally Hekking Rpt. (Pl. Ex. 1) at 60 and 110-113.

2. AEP System Generating Capability Commercial Operation Dates and Maximum Generator Name Plate Ratings (Pl. Ex. 118) at AEPHQ145017; Joint Stip. ¶ 42; Hekking Rpt. (Pl. Ex. 1) at 104.

3. Approval Notice, Dec. 24, 1986 (Jt. Ex. 196); Hekking Rpt. (Pl. Ex. 1) at 111.

4. OCPM Weekly Progress Report, Week Ending Jan. 27, 1988 (Pl. Ex. 502); OCPM Weekly Progress Report, Week Ending Sept. 2, 1988 (Pl. Ex. 503); Hekking Rpt. (Pl. Ex. 1) at 112; Tuppeny Rpt. (Def. Ex. 1524) at 92.

5. Capital Improvement Req. # 98066 (Jt. Ex. 128) at ARC-CD125415; Hekking Rpt. (Pl. Ex. 1) at 112.
6. Capital Improvement Req. # 98066 (Jt. Ex. 128) at ARC-CD125415.
7. Work Order Completion Report, 978/9248 (Jt. Ex. 230).
8. Manger's Weekly Letters, 1988 (Pl. Ex. 495) at CD217591-595, CD217540-543, CD217519-523, CD217450-454; Hekking Rpt. (Pl. Ex. 1) at 112.
9. Manger's Weekly Letters, 1988 (Pl. Ex. 495) at CD217591-595, CD217540-543, CD217519-523, CD217450-454; Hekking Rpt. (Pl. Ex. 1) at 112.
10. Manger's Weekly Letters, 1988 (Pl. Ex. 495) at CD217591-595, CD217540-543, CD217519-523, CD217450-454; Hekking Rpt. (Pl. Ex. 1) at 112; Tuppeny Rpt. (Def. Ex. 1524) at 92.
11. Capital Improvement Req. # 98066 (Jt. Ex. 128) at ARC-CD125419; Hekking Rpt. (Pl. Ex. 1) at 111.
12. Capital Improvement Req. # 98066 (Jt. Ex. 128) at ARC-CD125419; Hekking Rpt. (Pl. Ex. 1) at 111.
13. Capital Improvement Req. # 98066 (Jt. Ex. 128) at ARC-CD125419; Hekking Rpt. (Pl. Ex. 1) at 111; Tuppeny Rpt. (Def. Ex. 1524) at 91.
14. Capital Improvement Req. # 98066 (Jt. Ex. 128) at ARC-CD125422.
15. Capital Improvement Req. # 98066 (Jt. Ex. 128) at ARC-CD125419.
16. Tuppeny Rpt. (Def. Ex. 1524) at 91; Hekking Rpt. (Pl. Ex. 1) at 112.
17. Work Order Completion Report, 978/9248 (Jt. Ex. 230); Hekking Rpt. (Pl. Ex. 1) at 112; Larkin Rpt. (Pl. Ex. 1189) at 46.

ATTACHMENT B-7
Conesville 1: CI 75140¹

Unit Info./ Activity	125 MW/1959 ² CI 75140: Replaced four (4) complete cyclone assemblies, primary burners and re-entrant throats; approved by the Chairman on September 30, 1986 and the Board of Directors on October 29, 1986. ³
Nature	AEP hired Babcock and Wilcox to remove the old components, and fabricate and install the 4 cyclone furnace assemblies complete with headers, re-entrant throats, and radial cyclone burners. ⁴ The work was funded as a capital project. ⁵
Extent	Each of the 4 cyclones was 9 feet in diameter, weighed approximately 30,000 lbs. and incorporated many design improvements. The re-entrant throats were redesigned and weighed 5500 lbs. The radial primary burners each weighed 1500 lbs. and included primary/tertiary dampers. The dampers were redesigned. ⁶
Outage Dates	The outage lasted from May 16, 1987 to July 19, 1987. ⁷
Purpose	The purpose of the project was to improve the reliability of the replaced components for the duration of the unit's life. ⁸ AEP expected the project to eliminate 600 unit hours per year (escalating at an annual rate of 6%) of forced outages and curtailments. ⁹ It also expected the project to eliminate \$350,000 in annual maintenance costs (escalating at an annual rate of 10%), and the need to replace the cyclone casing twice at \$180,000 per replacement. ¹⁰
Frequency	The project marked the first time the cyclones were replaced. ¹¹
Capital Cost	The cost was \$2,764,461 for installation and approximately \$190,000 for removal. ¹²

1. See generally Hekking Rpt. (Pl. Ex. 1) at 121-131.
2. Joint Stip. ¶¶ 92 and 95; Hekking Rpt. (Pl. Ex. 1) at 121.
3. Capital Improvement Req. # 75140 (Jt. Ex. 215) at ARC-CV 128065; Hekking Rpt. (Pl. Ex. 1) at 126.
4. B & W, Cyclone Replacement Project, Conesville Units 1 and 2, Contract No. C-6650, Nov. 10, 1986 (Pl. Ex. 567) at CVP141575; Conesville Units 1 and 2, Contract Letter CV1&2-0587, Apr. 15, 1987 (Pl. Ex. 539); Hekking Rpt. (Pl. Ex. 1) at 126-128; Tuppeny Rpt. (Def. Ex. 1524) at 28.
5. Capital Improvement Req. # 75140 (Jt. Ex. 215) at ARC-CV 128068.
6. Specification CV1&2-0587, Conesville Units 1 and 2 (Pl. Ex. 566) at CVP141396-398; Capital Improvement Req. # 75140 (Jt. Ex. 215) at ARC-CV 128069; Hekking Rpt. (Pl. Ex. 1) at

126 and 128-129.

7. Unit #1 Outage Plan, Apr. 8, 1987 (Pl. Ex. 568) at CVP141911; Hekking Rpt. (Pl. Ex. 1) at 128 and 129.

8. Capital Improvement Req. # 75140 (Jt. Ex. 215) at ARC-CV 128069.

9. Capital Improvement Req. # 75140 (Jt. Ex. 215) at ARC-CV 128068, 128073 and 128074; Tuppeny Rpt. (Def. Ex. 1524) at 27.

10. Capital Improvement Req. # 75140 (Jt. Ex. 215) at ARC-CV 128073 and 128074.

11. Columbus Southern Power, Conesville (Cyclone User Questionnaire) (Pl. Ex. 561) at CVP134938; Hekking Rpt. (Pl. Ex. 1) at 129.

12. Property Record (Pl. Ex. 696) at PROP002405; Capital Improvement Req. # 75140 (Jt. Ex. 215) at ARC-CV 128066; Hekking Rpt. (Pl. Ex. 1) at 129; Larkin Rpt. (Pl. Ex. 1189) at 51.

ATTACHMENT B-8
Conesville 2: CI 75246¹

Unit Info./ Activity	125 MW/1957 ² CI 75246: Replaced four (4) complete cyclone assemblies, primary burners and re-entrant throats; approved by the Chairman on September 30, 1986 and the Board of Directors on October 29, 1986. ³
Nature	AEP hired Babcock and Wilcox to remove the old components, and fabricate and install the 4 cyclone furnace assemblies complete with headers, re-entrant throats, and radial cyclone burners. ⁴ The work was funded as a capital project. ⁵
Extent	Each of the 4 cyclones was 9 feet in diameter, weighed approximately 30,000 lbs. and incorporated many design improvements. The re-entrant throats were redesigned and weighed 5500 lbs. The radial primary burners each weighed 1500 lbs. and included primary/tertiary dampers. The dampers were redesigned. ⁶
Outage Dates	The outage lasted from June 26, 1987 to Sept. 4, 1987. ⁷
Purpose	The purpose of the project was to improve the reliability of the replaced components for the duration of the unit's life. ⁸ AEP expected the project to eliminate 600 unit hours per year (escalating at an annual rate of 6%) of forced outages and curtailments. ⁹ It also expected the project to eliminate \$350,000 in annual maintenance costs (escalating at an annual rate of 10%), and the need to replace the cyclone casing twice at \$180,000 per replacement. ¹⁰
Frequency	The project marked the first time the cyclones were replaced. ¹¹
Capital Cost	It cost \$2,818,144 for installation and approximately \$190,000 for removal. ¹²

1. See generally Hekking Rpt. (Pl. Ex. 1) at 121 and 131-138.

2. Joint Stip. ¶¶ 93 and 95; Hekking Rpt. (Pl. Ex. 1) at 121.

3. Capital Improvement Req. # 75246 (Jt. Ex. 68) at CVC111832; Hekking Rpt. (Pl. Ex. 1) at 133.

4. B & W, Cyclone Replacement Project, Conesville Units 1 and 2, Contract No. C-6650, Nov. 10, 1986 (Pl. Ex. 567) at CVP141575; Conesville Units 1 and 2, Contract Letter CV1&2-0587, Apr. 15, 1987 (Pl. Ex. 539); Hekking Rpt. (Pl. Ex. 1) at 134 and 135; Tuppeny Rpt. (Def. Ex. 1524) at 28.

5. Capital Improvement Req. # 75246 (Jt. Ex. 68) at CVC111834; Glenn Davis Depo. at 84:10-21.

6. Specification CV1&2-0587, Conesville Units 1 and 2 (Pl. Ex. 566) at CVP141396-398; Capital Improvement Req. # 75246 (Jt. Ex. 68) at CVC111835; Hekking Rpt. (Pl. Ex. 1) at 133 and 135-136.
7. Volume 1, Unit 2 Outage Report, 6/26/87 - 9/4/87 (Jt. Ex. 165) at CVP104942; Hekking Rpt. (Pl. Ex. 1) at 135 and 136.
8. Capital Improvement Req. # 75246 (Jt. Ex. 68) at CVC111835; Glenn Davis Depo. at 87:15-88:22.
9. Capital Improvement Req. # 75246 (Jt. Ex. 68) at CVC111834, 111839 and 111840; Glenn Davis Depo. at 83:1-20; Tuppeny Rpt. (Def. Ex. 1524) at 27.
10. Capital Improvement Req. # 75246 (Jt. Ex. 68) at CVC111839 and 111840.
11. Columbus Southern Power, Conesville (Cyclone User Questionnaire) (Pl. Ex. 561) at CVP134938; Glenn Davis Depo. at 87:24-88:2; Hekking Rpt. (Pl. Ex. 1) at 136.
12. Work Order Cumulative Report as of Apr. 30, 1989, prepared May 12, 1989 (Pl. Ex. 1267); Capital Improvement Req. # 75246 (Jt. Ex. 68) at CVC111831; Hekking Rpt. (Pl. Ex. 1) at 136; Larkin Rpt. (Pl. Ex. 1189).

ATTACHMENT B-9
Conesville 2: CI 75312¹

Unit Info./ Activity	125MW/1957 ² CI 75312: Replaced the furnace floor tubing; approved by the Chairman on August 17, 1988. ³
Nature	AEP hired Babcock and Wilcox to replace the entire furnace floor. ⁴ The project included improvements to the floor tube design. ⁵ The project was approved by more than 10 people, including the AEP president and chairman of the board of directors. ⁶ The work was funded as a capital project. ⁷
Extent	The furnace floor tubing covered an area of 536 square feet. ⁸ It was installed in twelve prefabricated panels (two panels were seven tubes wide, one panel was nine tubes wide and nine panels were eight tubes wide.) ⁹ Babcock & Wilcox estimated that up to 36 craftsmen would work two 10-hour shifts over 20 days to complete the replacement. ¹⁰
Outage Dates	The outage lasted from August, 19, 1989 to October 5, 1989, extending five days longer than scheduled because of the furnace floor replacement. ¹¹
Purpose	The project was intended to restore the unit's "availability for 50 year service life," adding 20 years to the expected life of the life, and "eliminate the potential for floor tube leaks in the area." ¹² AEP expected the project to eliminate 375 hours per year of curtailments and forced outages. ¹³ The project was also expected to eliminate \$75,000 in annual maintenance costs and \$350,000 in major maintenance costs incurred every five years, while also allowing the unit to generate an additional \$175,000 in annual electricity sales by avoiding forced outages attributed to the furnace floor tubes. ¹⁴ The change in the tube stud design was intended to "allow for better inspection and maintenance." ¹⁵
Frequency	The project marked the first time the furnace floor tubes were replaced. ¹⁶
Capital Cost	The cost was \$934,103 for installation and approximately \$175,000 for removal. ¹⁷

1. See generally Hekking Rpt. (Pl. Ex. 1) at 121 and 138-143.
2. Joint Stip. ¶¶ 93 and 95; Hekking Rpt. (Pl. Ex. 1) at 121.
3. Capital Improvement Req. # 75312 (Jt. Ex. 45) at ARC-CV128034; Hekking Rpt. (Pl. Ex. 1) at 140.
4. Contract Letter CV2-0789, July 25, 1989 (Pl. Ex. 319); Hekking Rpt. (Pl. Ex. 1) at 140; Tuppeny Rpt. (Def. Ex. 1524) at 30.
5. Capital Improvement Req. # 75312 (Jt. Ex. 45) at ARC-CV128036; Hekking Rpt. (Pl. Ex. 1) at 143; Tuppeny Rpt. (Def. Ex. 1524) at 29-30.

6. Capital Improvement Req. # 75312 (Jt. Ex. 45) at ARC-CV128034; Hekking Rpt. (Pl. Ex. 1) at 140.
7. Capital Improvement Req. # 75312 (Jt. Ex. 45) at ARC-CV128036.
8. Columbus and Southern Ohio Electric Co., Steam and Peaking Unit Specifications (Pl. Ex. 201) at AEPHQ241943.
9. Specification CV2-0789 (Pl. Ex. 320) at ARC-CV113746; Hekking Rpt. (Pl. Ex. 1) at 141.
10. Outage Summary: Conesville Unit 2, Oct. 9, 1989 (Pl. Ex. 976) at ARC-CR105464; B & W Construction Proposal, July 5, 1989 (Pl. Ex. 324) at ARC-CV113831; Hekking Rpt. (Pl. Ex. 1) at 141.
11. Outage Summary: Conesville Unit 2, Oct. 9, 1989 (Pl. Ex. 976) at ARC-CR105464; Conesville Unit 2 1989 Outage Plans, July 7, 1989 (Pl. Ex. 319) at ARC-CR105419; Hekking Rpt (Pl. Ex. 1) at 141.
12. Steam Generator (Jt. Ex. 50) at ARC-MR106903; Capital Improvement Req. # 75312 (Jt. Ex. 45) at ARC-CV128036; Hekking Rpt. (Pl. Ex. 1) at 139 and 142.
13. Capital Improvement Req. # 75312 (Jt. Ex. 45) at ARC-CV128041-43; Glenn Davis Depo. at 43:1-21 and 46:3-8; Hekking Rpt. (Pl. Ex. 1) at 140.
14. Capital Improvement Req. # 75312 (Jt. Ex. 45) at ARC-CV128041-43; Glenn S. Davis Depo. at 43:16-21; Glenn Davis Depo. at 45:13-46:24; Hekking Rpt. (Pl. Ex. 1) at 139-140.
15. Capital Improvement Req. # 75312 (Jt. Ex. 45) at ARC-CV128036.
16. Capital Improvement Req. # 75312 (Jt. Ex. 45) at ARC-CV128036; Columbus Southern Power Co., C/R/O Workorder 209001 (Pl. Ex. 549) at CVC152778; Hekking Rpt. (Pl. Ex. 1) at 139.
17. Property Record (Pl. Ex. 697); Capital Improvement Req. # 75312 (Jt. Ex. 45) at ARC-CV128035; Hekking Rpt. (Pl. Ex. 1) at 141-142; Larkin Rpt. (Pl. Ex. 1189) at 54.

ATTACHMENT B-10
Conesville 3: CI 75285¹

Unit Info./ Activity	165MW/1962 ² CI 75285: Replaced the economizer; approved by the Chairman on November 20, 1987. ³
Nature	AEP purchased the new economizer elements from Babcock and Wilcox, and hired Union Boiler to remove the old economizer and install the new one. ⁴ The project was funded through the capital budget. ⁵
Extent	The economizer consisted of 116 tube sections, each weighing approximately 1300 pounds for a total weight of about 75 tons. ⁶ The economizer provides 15,000 square feet of heating surface. ⁷ Union Boiler constructed a temporary monorail to transport the economizer sections. ⁸ Union Boiler expected to employ approximately 20 workers in 8-hour shifts five days per week during the 10-week outage. ⁹
Outage Dates	The outage lasted from September 17, 1988 to November 30, 1988. ¹⁰
Purpose	AEP replaced the economizer to eliminate a cause of increasing forced outages; economizer tube failures caused 6 forced outages in the 18 months ending September 23, 1987. ¹¹ AEP projected that the replacement would eliminate 360 hours of forced outages annually, with the curtailment time increasing three percent per year due to further deterioration in the economizer. ¹² Economizer tube failures were the unit's leading cause of forced outages from 1983 to 1987, accounting for 22 percent of all forced outages during that span. ¹³ The company anticipated saving \$30,000 in annual maintenance costs and generating an additional \$193,000 in annual electricity sales by avoiding forced outages caused by the economizer. ¹⁴ After the project was completed, AEP stated that the project "restored the integrity of the economizer for 50 year service." ¹⁵
Frequency	This was the first time the economizer had been replaced. ¹⁶
Capital Cost	It cost \$566,928 for installation and approximately \$102,000 for removal. ¹⁷

1. See generally Hekking Rpt. (Pl. Ex. 1) at 121 and 143-148.
2. Joint Stip. ¶¶ 94 and 96; Hekking Rpt. (Pl. Ex. 1) at 121.
3. Capital Improvement Req. # 75285 (Jt. Ex. 183) at 1RP40403; Hekking Rpt. (Pl. Ex. 1) at 145.
4. Purchase Order No. 28053-101-8X, March 31, 1988 (Pl. Ex. 572); Specification CV-SG-301 (Pl. Ex. 973) at ARC-CR103495-497; Contract Letter CV3-0988, July 29, 1988 (Pl. Ex. 578); Hekking Rpt. (Pl. Ex. 1) at 145 and 146; Tuppeny Rpt. (Def. Ex. 1524) at 32.

5. Capital Improvement Req. # 75285 (Jt. Ex. 183) at 1RP40407; Hekking Rpt. (Pl. Ex. 1) at 147.
6. Specification CV-SG-301 (Pl. Ex. 973) at ARC-CR103509; Hekking Rpt. (Pl. Ex. 1) at 144.
7. Conesville Plant, Capital Improvement Requisitions (Pl. Ex. 1227) at AEPHQ149974.
8. Conesville Pant Unit 3, Economizer Replacement, Contract Letter CV3-0988, September 1, 1988 (Pl. Ex. 570).
9. Conesville Pant Unit 3, Economizer Replacement, Contract Letter CV3-0988, September 1, 1988 (Pl. Ex. 570) at 55.
10. Outage Summary Conesville Unit 3 1988 Outage, Dec. 20, 1988 (Pl. Ex. 977) at ARC-CR106155; Hekking Rpt. (Pl. Ex. 1) at 146.
11. Capital Improvement Req. # 75285 (Jt. Ex. 183) at 1RP40407; Hekking Rpt. (Pl. Ex. 1) at 145.
12. Capital Improvement Req. # 75285 (Jt. Ex. 183) at 1RP40411-413; Hekking Rpt. (Pl. Ex. 1) at 145.
13. Percentage of Total Forced Outage and Lost Partial Hours by Component, Conesville Unit 3, 1983 - 1987 (Pl. Ex. 1977); Hekking Rpt. (Pl. Ex. 1) at 144.
14. Capital Improvement Req. # 75285 (Jt. Ex. 183) at 1RP40412-413; Hekking Rpt. (Pl. Ex. 1) at 145.
15. Steam Generator (Jt. Ex. 50) at ARC-MR106905; Hekking Rpt. (Pl. Ex. 1) at 147.
16. Capital Improvement Req. # 75285 (Jt. Ex. 183) at 1RP40407; Hekking Rpt. (Pl. Ex. 1) at 147.
17. Property Record (Pl. Ex. 698) at PROP002554; Capital Improvement Req. # 75285 (Jt. Ex. 183) at 1RP40406; Hekking Rpt. (Pl. Ex. 1) at 147; Larkin Rpt. (Pl. Ex. 1189) at 55.

ATTACHMENT B-11
Muskingum River 1: CI 72172¹

Unit Info./ Activity	205MW/1953 ² CI 72172: Replaced inlet and outlet tube assemblies for the secondary superheater; approved by the Chairman on January 12, 1987 and Board of Directors on January 29, 1987. ³ CI 72172, Rev. 1: Reduced approval amount by \$594,000; approved by the Chairman on March 16, 1989. ⁴
Nature	AEP conducted extensive repairs to the support system during annual outages, but the superheater had reached the end of its useful life. ⁵ AEP hired Minnotte Contracting Corp. to replace the inlet and outlet tube assemblies for the secondary superheater. ⁶ CI 72172 was prepared by an employee of the Fossil Plant Engineering Division of AEPSC. ⁷ The project was approved by more than 10 people, including the AEP president and chairman of the board of directors. ⁸ The work was funded as a capital project. ⁹
Extent	Minnotte replaced two secondary superheater inlet headers, each was 13" OD, 168 inlet legs, 56 inlet platens, 84 outlet platens, and 84 outlet legs. ¹⁰ Minnotte also upgraded the secondary superheater support system. ¹¹
Outage Dates	The outage lasted from April 15, 1988 to May 31, 1988. ¹²
Purpose	The project was intended to restore the superheater's reliability and improve the unit's availability. ¹³ The unit had experienced three tube failures due to the secondary tube heater in 1985, for a total of 250 forced outage hours, and AEP expected the failures to increase at an annual rate of 15 percent. ¹⁴ AEP expected the project to eliminate 375 hours per year of curtailment hours. ¹⁵ In addition, AEP expected to save \$45,000 per year in maintenance costs with an escalation rate of 25 percent per year. ¹⁶
Frequency	The project was the first time the entire inlet and outlet tube assemblies and support system for the secondary superheater were replaced. ¹⁷
Capital Cost	The cost was \$1,653,553 for installation and approximately \$430,000 for removal. ¹⁸

1. See generally Hekking Rpt. (Pl. Ex. 1) at 215-220.

2. Joint Stips. ¶¶157 and 158; Hekking Rpt. (Pl. Ex. 1) at 215.

3. Capital Improvement Req. # 72172 (Jt. Ex. 181) at 1RP001693; Hekking Rpt. (Pl. Ex. 1) at 217.

4. Capital Improvement Req. # 72172, Rev. 1 (Jt. Ex. 260) at 1RP001682; Scott Vierstra Depo. at 78:11-14.

5. Capital Improvement Req. # 72172 (Jt. Ex. 181) at 1RP001697.
6. Contract Agreement Letter C-7103, Jan. 21, 1988 (Pl. Ex. 350); Hekking Rpt. (Pl. Ex. 1) at 218; Tuppeny Rpt. (Def. Ex. 1524) at 25.
7. Capital Improvement Req. # 72172 (Jt. Ex. 181) at 1RP001694; Hekking Rpt. (Pl. Ex. 1) at 217.
8. Capital Improvement Req. # 72172 (Jt. Ex. 181) at 1RP001693.
9. Capital Improvement Req. # 72172 (Jt. Ex. 181) at 1RP001693; Hekking Rpt. (Pl. Ex. 1) at 219.
10. Specification MR1&2-1287 (Pl. Ex. 1003) at ARC-MR135284 and 135293; Hekking Rpt. (Pl. Ex. 1) at 216 and 218; Tuppeny Rpt. (Def. Ex. 1524) at 25.
11. Capital Improvement Req. # 72172 (Jt. Ex. 181) at 1RP001697; Specification MR1&2-1287 (Pl. Ex. 1003) at ARC-MR135284 and 135293; Hekking Rpt. (Pl. Ex. 1) at 218; Koppe Rpt. (Pl. Ex. 858) at 143, 145.
12. Muskingum River Plant, Unit #1 Annual Outage, Apr. 15, 1988 to May 31, 1988 (Pl. Ex. 639) at MR104290; Hekking Rpt. (Pl. Ex. 1) at 218.
13. Capital Improvement Req. # 72172 (Jt. Ex. 181) at 1RP001692.
14. Capital Improvement Req. # 72172 (Jt. Ex. 181) at 1RP001692 and 001702; Scott Vierstra Depo. at 48:24-50:5 and 62:18-63:16; Tuppeny Rpt. (Def. Ex. 1524) at 25; Koppe Rpt. (Pl. Ex. 858) at 143-144.
15. Capital Improvement Req. # 72172 (Jt. Ex. 181) at 1RP001702; Koppe Rpt. (Pl. Ex. 858) at 143.
16. Capital Improvement Req. # 72172 (Jt. Ex. 181) at 1RP001702.
17. Capital Improvement Req. # 72172 (Jt. Ex. 181) at 1RP001692; Hekking Rpt. (Pl. Ex. 1) at 216 and 218; Tuppeny Rpt. (Def. Ex. 1524) at 24.
18. Property Record (Pl. Ex. 1280) at AT003740, 743-745; Work Order Completion Report, 805/2630 (Jt. Ex. 239); Hekking Rpt. (Pl. Ex. 1) at 218; Larkin Rpt. (Pl. Ex. 1189) at 79.

ATTACHMENT B-12
Muskingum River 2: CI 72173¹

Unit Info./ Activity	205MW/1954 ² CI 72173: Replaced inlet and outlet tube assemblies for the secondary superheater; approved by the Chairman on January 12, 1987 and the Board of Directors on January 29, 1987. ³ CI 72173, Rev. 1: Reduced approval amount by \$735,000; approved by the Chairman on March 16, 1989. ⁴
Nature	AEP conducted extensive repairs to the support system during annual outages, but the superheater had reached the end of its useful life. ⁵ AEP hired Minnotte Contracting Corp. to replace the inlet and outlet tube assemblies for the secondary superheater. ⁶ CI 72173 was prepared by an employee of the Fossil Plant Engineering Division of AEPSC. ⁷ The project was approved by more than 10 people, including the AEP president and chairman of the board of directors. ⁸ The work was funded as a capital project. ⁹
Extent	Minnotte replaced two secondary superheater inlet headers, each was 13" OD, 168 inlet legs, 56 inlet platens, 84 outlet platens, and 84 outlet legs. ¹⁰ Minnotte also upgraded the secondary superheater support system. ¹¹
Outage Dates	The outage lasted from February 6, 1988 to April 24, 1988. ¹²
Purpose	The project was intended to restore the superheater's reliability and improve the unit's availability. ¹³ The unit had experienced three tube failures due to the secondary tube heater in both 1985 and 1986, for a total of 293 forced outage hours in 1985, and AEP expected the failures to increase at an annual rate of 15 percent. ¹⁴ AEP expected the project to eliminate 375 curtailment hours per year. ¹⁵ In addition, AEP expected to save \$45,000 per year in maintenance costs with an escalation rate of 25 percent per year. ¹⁶
Frequency	The project was the first time the entire inlet and outlet tube assemblies and support system for the secondary superheater were replaced. ¹⁷
Capital Cost	The cost was \$1,579,088 for installation and approximately \$430,000 for removal. ¹⁸

1. See generally Hekking Rpt. (Pl. Ex. 1) at 215-220.

2. Joint Stips. ¶¶159 and 160; Hekking Rpt. (Pl. Ex. 1) at 215.

3. Capital Improvement Req. # 72173 (Jt. Ex. 132) at ARC-CORPB-COL137284; Hekking Rpt. (Pl. Ex. 1) at 217.

4. Capital Improvement Req. # 72173, Rev. 1 (Jt. Ex. 41) at ARC-CORPB-COL137272; Scott Vierstra Depo. at 88:1-12.
5. Capital Improvement Req. # 72173 (Jt. Ex. 132) at ARC-CORPB-COL137288.
6. Contract Agreement Letter C-7103, Jan. 21, 1988 (Pl. Ex. 350); Hekking Rpt. (Pl. Ex. 1) at 218; Tuppeny Rpt. (Def. Ex. 1524) at 25.
7. Capital Improvement Req. # 72173 (Jt. Ex. 132) at ARC-CORPB-COL137287; Hekking Rpt. (Pl. Ex. 1) at 217.
8. Capital Improvement Req. # 72173 (Jt. Ex. 132) at ARC-CORPB-COL137284.
9. Capital Improvement Req. # 72173 (Jt. Ex. 132) at ARC-CORPB-COL137284; Hekking Rpt. (Pl. Ex. 1) at 216 and 219.
10. Specification MR1&2-1287 (Pl. Ex. 1003) at ARC-MR135284 and 135293; Hekking Rpt. (Pl. Ex. 1) at 216 and 218; Tuppeny Rpt. (Def. Ex. 1524) at 25.
11. Capital Improvement Req. # 72173 (Jt. Ex. 132) at ARC-CORPB-COL137288; Specification MR1&2-1287 (Pl. Ex. 1003) at ARC-MR135284 and 135293; Hekking Rpt. (Pl. Ex. 1) at 218; Koppe Rpt. (Pl. Ex. 858) at 143, 145.
12. Muskingum River Unit 2, Outage Summary (Jt. Ex. 136) at ARC-MR135541; Hekking Rpt. (Pl. Ex. 1) at 218.
13. Capital Improvement Req. # 72173 (Jt. Ex. 132) at ARC-CORPB-COL137283.
14. Capital Improvement Req. # 72173 (Jt. Ex. 132) at ARC-CORPB-COL137288 and 137293; Tuppeny Rpt. (Def. Ex. 1524) at 25; Koppe Rpt. (Pl. Ex. 858) at 143, 145.
15. Capital Improvement Req. # 72173 (Jt. Ex. 132) at ARC-CORPB-COL137283, 288-289, 293; Koppe Rpt. (Pl. Ex. 858) at 143.
16. Capital Improvement Req. # 72173 (Jt. Ex. 132) at ARC-CORPB-COL137293; Hekking Rpt. (Pl. Ex. 1) at 217.
17. Capital Improvement Req. # 72173 (Jt. Ex. 132) at ARC-CORPB-COL137283; Hekking Rpt. (Pl. Ex. 1) at 216 and 219; Tuppeny Rpt. (Def. Ex. 1524) at 24.
18. Work Order Completion Report, 705/2640 (Pl. Ex. 1329); Work Order Completion Report, 805/2610 (Jt. Ex. 238); Property Record (Pl. Ex. 1280) at AT003745; Hekking Rpt. (Pl. Ex. 1) at 219; Larkin Rpt. (Pl. Ex. 1189) at 83.